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$$3a^2(m - \frac{1}{m}) + 4ay + (x^2 + y^2 - 4ax)(m - \frac{1}{m}) = 0; \text{ or}$$

$$3a^2p + 4ay + (x^2 + y^2 - 4ax)p = 0 \dots (\text{II}).$$

From (II), we get  $p = -\frac{4ay}{x^2 + y^2 - 4ax + 3a^2}$ , and substituting this in (I), we get

$$(x^2 + y^2 + 3a^2 - 4ax)^2 (3a^2 + 10ax - x^2 - y^2) - 16a^2y^2(x^2 + y^2 - 4ax) = 0.$$

Also solved by M. A. Harding, S. Lefschetz, and A. H. Holmes.

367. Proposed by E. B. ESCOTT, University of Michigan, Ann Arbor, Michigan.

Solve the simultaneous equations:

$$\frac{2x}{1+x^2} = y \dots (1); \quad \frac{2y}{1+y^2} = z \dots (2); \quad \frac{2z}{1+z^2} = u \dots (3); \quad \frac{2u}{1+u^2} = x \dots (4).$$

Solution by PROFESSOR F. L. GRIFFIN, Reed College, Portland, Oregon.

By inspection three solutions are  $x=y=z=u=1$ , or  $-1$ , or  $0$ ; and there can be but fourteen others. Now let  $x=itan\theta$ , [ $i=\sqrt{-1}$ ], whence  $y=itan2\theta$ ,  $z=itan4\theta$ ,  $u=itan8\theta$ , and  $x=itan16\theta$ . But  $tan16\theta=tan\theta$  for finite values of  $\theta$  only if  $16\theta=\theta+n\pi$ , or  $\theta=n\pi/15$ . Thus we have

$$x=0, \quad itan\pi/15, \quad itan2\pi/15, \quad itan3\pi/15, \quad \dots, \quad itan14\pi/15;$$

$$y=0, \quad itan2\pi/15, \quad itan4\pi/15, \quad itan6\pi/15, \quad \dots, \quad itan28\pi/15;$$

$$z=0, \quad itan4\pi/15, \quad itan8\pi/15, \quad itan12\pi/15, \quad \dots, \quad itan56\pi/15;$$

$$u=0, \quad itan8\pi/15, \quad itan16\pi/15, \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots$$

the values for  $y$ ,  $z$ ,  $u$  being of course the same sets as for  $x$  in different orders. The values  $x=+1$ ,  $-1$  correspond to infinite values of  $\theta$  for which  $\tan\theta=-i$ ,  $+i$ .

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### GEOMETRY.

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393. Proposed by S. LEFSEHETZ, University of Nebraska.

Draw a triangle having a given angle, and with its vertices on three given concentric circles.

I. Solution by H. C. FEEMSTER, A. B., Professor of Mathematics, York College, York, Nebraska.

Let  $x^2 + y^2 = c^2$ ,  $x^2 + y^2 = b^2$ ,  $x^2 + y^2 = a^2$ , be the given circles, and  $\phi$  the given angle. Place the vertex of the given angle,  $\phi$ , on the circumference of the first circle at  $0$ ,  $c$ , the angle being formed by the lines,